

WHAT IS CLAIMED IS:

1. A method for determining bit wear in a drill  
bit of a drilling rig system comprising:  
providing a first drill bit design, the first drill  
5 bit design having a first geometry;  
generating a geological model of given formation,  
the geological model including a geological  
characteristic based on a length of formation drilled in  
a given amount of time; and  
10 predicting the first wear rate of the first drill  
bit design based on the first geometry compared to the  
geological model for the length of formation drilled.
  2. The method of Claim 1, further comprising:  
15 incrementing along the length of the formation  
drilled of the geological model;  
based on the increment, predicting a second wear  
rate for the first drill bit; and  
cumulating the first wear rate and the second wear  
20 rate to determine a total bit wear.
  3. The method of Claim 2, further comprising  
predicting a cumulative bit wear over the length of the  
formation drilled of the geological model.
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4. The method of Claim 1, further comprising:  
varying a drilling factor along the geological model  
using the first drill bit design;  
predicting a second bit wear rate for the first  
5 drill bit; and  
comparing the second bit wear rate to the first bit  
wear rate to determine whether a varied drilling factor  
increased the bit wear.

10 5. The method of Claim 4, wherein the drilling  
factor is selected from a group consisting of rate of  
penetration, weight on bit, torque, rotary rpm and bit  
sharpness.

15 6. The method of Claim 2, further comprising:  
selecting a second drill bit design, the second  
drill bit having a second geometry;  
predicting a second bit design wear rate of the  
second drill bit design based on the second geometry  
20 compared to the geological model for the length of  
formation drilled; and  
comparing the second bit design wear rate to the  
wear rate for the first drill bit design to select a  
preferred drill bit design.

25 7. The method of Claim 5, further comprising  
displaying the preferred drill bit design.

8. The method of Claim 1, wherein the first and  
30 second geometry including a 3D model of a drill bit  
design.

9. The method of Claim 1, wherein the geological characteristic is selected from a group consisting of log data, lithology, porosity, rock strength, and plasticity.

- 5        10. A program product for predicting the performance of drilling system, the program product comprising:
- a computer-usable medium; and
  - computer instructions encoded in the computer-usable
  - 10 medium, wherein the computer instructions, when executed, cause a computer to perform operations comprising:
    - providing a first drill bit design, the
    - first drill bit design having a first geometry;
    - generating a geological model of given
    - 15 formation, the geological model including a geological characteristic based on a length of formation drilled in a given amount of time; and
    - predicting the first wear rate of the
    - first drill bit design based on the first geometry
    - 20 compared to the geological model for the length of formation drilled.

11. The program product of Claim 10, wherein the computer instructions further comprising:
- 25 incrementing along the length of the formation drilled of the geological model;
  - based on the increment, predicting a second wear rate for the first drill bit; and
  - cumulating the first wear rate and the second wear
  - 30 rate to determine a total bit wear.

12. The program product of Claim 11, wherein the computer instructions further comprising predicting a cumulative bit wear over the length of the formation drilled of the geological model.

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13. The program product of Claim 10, wherein the computer instructions further comprising:

varying a drilling factor along the geological model using the first drill bit design;

10 predicting a second bit wear rate for the first drill bit; and

comparing the second bit wear rate to the first bit wear rate to determine whether a varied drilling factor increased the bit wear.

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14. The program product of Claim 11, wherein the computer instructions further comprising:

selecting a second drill bit design, the second drill bit having a second geometry;

20 predicting a second bit design wear rate of the second drill bit design based on the second geometry compared to the geological model for the length of formation drilled; and

25 comparing the second bit design wear rate to the wear rate for the first drill bit design to select a preferred drill bit design.

15. The program product of Claim 10, wherein the computer instructions further comprising displaying the preferred drill bit design.

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16. The program product of Claim 10, wherein the first and second geometry including a 3D model of a drill bit design.

5        17. The program product of Claim 10, wherein the computer instructions further comprising generating a real-time wear modeling of a first drill bit design based on a drilling operation.

10       18. A method for using drill bit model for drilling operations comprising:

         providing a drill bit model for a first drill bit;  
         simulating a drilling operation for drilling in a given formation using the drill bit model, the given

15       formation having a rock compressive strength;  
         based on the simulation, generating at least one parameter for the first drill bit;

         comparing the at least one parameter of the drilling operation of the given formation to a parameter of a  
20       second drill bit;

         based on the comparison, selecting a preferred drill bit for drilling the given formation.

         19. The method of Claim 18, wherein the at least  
25       one parameter selected from a group consisting of an axial projected contact area, a theoretical work rating, a work rating, a wear characteristic, a cumulative work-wear relationship, a friction slope, a sharp cutting line slope, and a worn cutting line slope.

30       20. The method of Claim 18, wherein the drill bit model comprises a 3-D model of the drill bit.

21. The method of Claim 18, further comprising  
storing the drill bit model on a computer.

22. The method of Claim 18, further comprising  
5 displaying the preferred drill bit.